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Circular No. 890

November 1951 • Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE

Deseeding of Fiber Flax

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United States Department of Agriculture, in cooperation with the Oregon Agricultural Experiment Station

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The future of the flax industry in the United States hinges heavily on the degree of mechanization developed to offset low cost of labor in other flax-growing countries that depend largely on centuries-old hand-processing methods. Despite considerable progress in mechanization in the last several decades, some phases of processing are not greatly developed. This circular describes more recent developments in deseeding machines.

A fiber-flax plant is similar to plants of wheat, barley, and other small grains except that it has lateral branches near the top that support the seed pods. One completely filled seed pod contains 8 to 10 seeds.

To extract the linen fiber from the flax plant satisfactorily, several processing steps are required. These operations include (1) pulling, or harvesting, of the flax; (2) deseeding, or separation of the flaxseed and seed pods from the plants; (3) retting, or rotting, to dissolve the pectins that cement the flax fibers to the rest of the plant; (4) drying, to remove the retting water and stop the deterioration; (5) scutching, or the separation of flax fibers from the straws; and (6) hackling, or combing the fiber.

Deseeding is the separation of the ripe seed from the plant, either by crushing the seed pods or by severing the seed-pod branch. The seed pods are processed through a conventional threshing machine to separate the seed from the chaff. Some of the seed is used for planting, and some is sold in markets established for seed flax to be crushed for oil and meal.

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Deseeding is one of the processing operations that has advanced materially with the development of new machines in the United States. Machines used for deseeding range from the ancient ripple frame used by the Cavaliers and the Pilgrims in the early colonial days to the latest experimental model of a revolving-comb machine equipped with an automatic straw-spreading, conveying, butting, and bundle-forming mechanism.

DEVELOPMENT OF DESEEDING METHODS

An Early Method

One of the early methods of deseeding mentioned in history was by beating the seed end of the flax with clubs until the pods were crushed and the seed liberated (fig. 1). Considerable hand labor and time were required to deseed flax by this method.

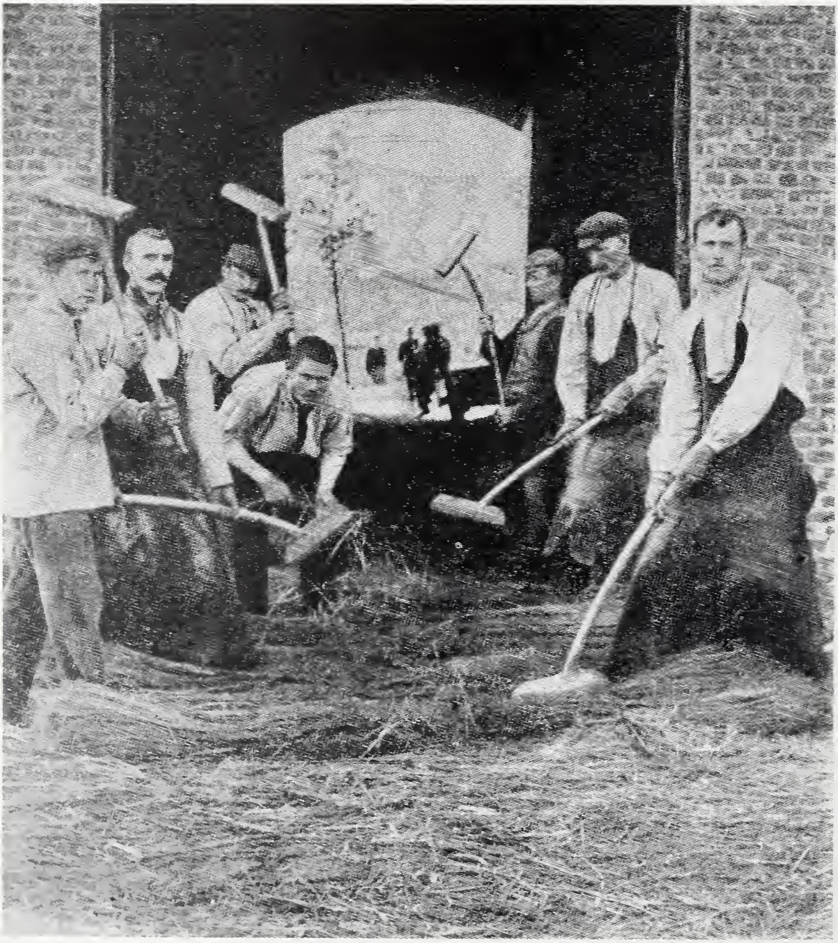

Figure 1.—Flax deseeding with clubs.

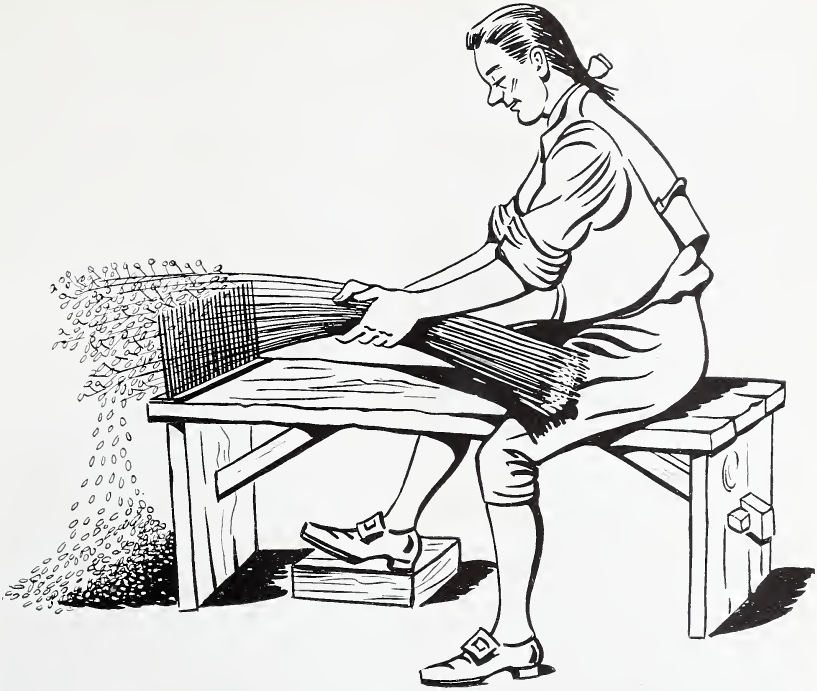

FIGURE 2.—Flax deseeding with a ripple deseeder.

RIPPLE DESEEDER

The ripple deseeder (fig. 2) used by the early settlers in colonial America consisted of a series of metal pins mounted on a stand to form a stationary comb. The operator removed the bundle ties, spread the flax heads, then manually drew the seed end of the flax through the combs, which pulled off the seed. The seeds were caught in a sheet spread beneath the stand. It required approximately 20 man-hours to remove and thresh the seed from a ton of pulled flax. The ripple deseeder is no longer used in the United States, but it is still used in parts of the Old World.

WHIPPER DESEEDER

The whipper deseeder was used exclusively by the United States commercial fiber-flax processors from 1915 until the comb-type deseeder, imported from Europe, was introduced in 1936.

The whipper deseeder (fig. 3) consists of two sets of steel rollers mounted on the ends of parallel shafts and supported by the necessary frame and bearings. One shaft is mounted in stationary bearings and is power-driven. The second shaft is mounted in spring-tension slide bearings and is driven by friction through the rollers. The rollers revolve into each other so rapidly that the impression of whipping, or slashing, is given. The operator passes the head end of the flax between the rollers, which crush the seed pods and liberate the seed.

A crew of 10 men is usually employed to operate a whipper deseeder. Such a crew consists of 1 bundle pitcher, 1 band cutter, 2 whippers, 2 eveners, 1 binder, 2 loaders, and 1 threshing machine operator. In addition, personnel are required to load, unload, and haul the flax to and from the deseeder. The whipper deseeder requires about 10 man-hours to process a ton of flax.

Rake-Type Comb Deseeder

A rake-type comb deseeder was imported from Belgium in 1936. The comb resembled a heavy fork mounted on a crank with linkage that held the comb beam in such a position that the teeth traveled in an elliptical path, removing the seed pods. The gripping and conveying device consisted of two rubber belts with heavily ridged facings. The machine consisted of the comb and its linkage, the gripping and conveying device, and the necessary bearings, frame, and pulleys.

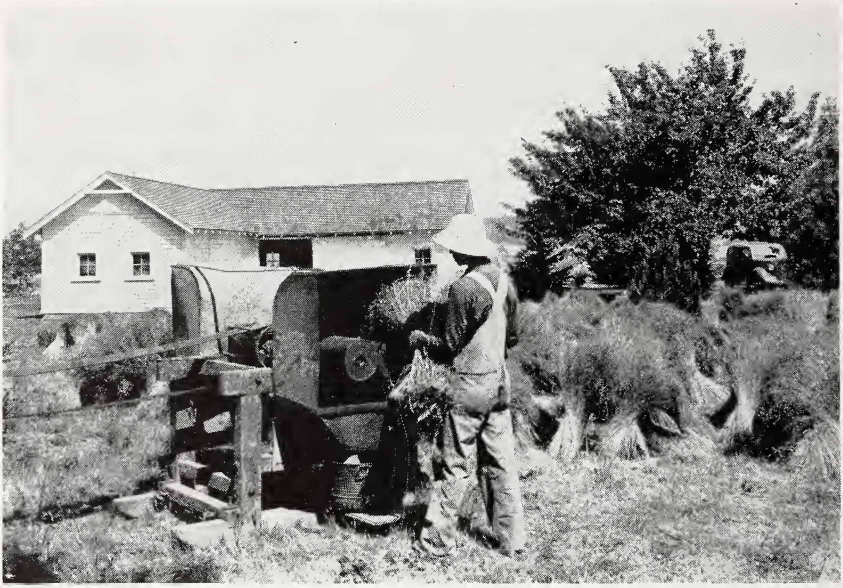

Figure 3.—A whipper deseeder set up in the field for plot samples of fiber-flax straw.

In 1939 a new rake-type deseeder was imported from Belgium that combed both the butt and the head end of the straw. The gripping and conveying device was comprised of a pneumatic-tired wheel and a heavy rubber belt.

Both machines were discarded because of their low capacity and the mechanical difficulties of keeping them in operation.

The last machine had at least two advantages over previous deseeders: (1) The gripping and conveying device handled a continuous layer of flax straw, which facilitated straight-line deseeding; and (2) combs on the root end paralleled the straw and removed dirt, weeds, and tangled straw—and thus prepared the flax for better handling throughout the processing.

Revolving-Comb Deseeder

In 1938 agricultural engineers of the United States Department of Agriculture began the design and construction of an experimental rotary comb-type deseeder.[1] The experimental unit consisted of a revolving drum with three combing assemblies and a gripping and conveying device of five steel cables and a wooden wheel. The unit was designed so that the combs entered the seed end of the flax straw near the gripping device and remained in a vertical position as they moved outward to remove the seed pods. The multiple-comb assembly made it possible to increase the speed of the conveying device over that of the rake-type deseeder and at the same time maintain a relatively slow speed of the combs through the straw. The unit was tested and found to deseed flax straw efficiently, but the steel-cable gripping device proved to be inadequate. A second model was constructed, using two drum-comb assemblies, a heavy rubber belt, and a pneumatic-tired gripping and conveying device (fig. 4). One set of combs deseeded the straw; and the other comb set, pulling in the opposite direction, cleaned dirt and trash from the root ends. Flax straw processed on the double-drum revolving-comb machine was found to be more manageable and to form neater wigwams in the drying field than those

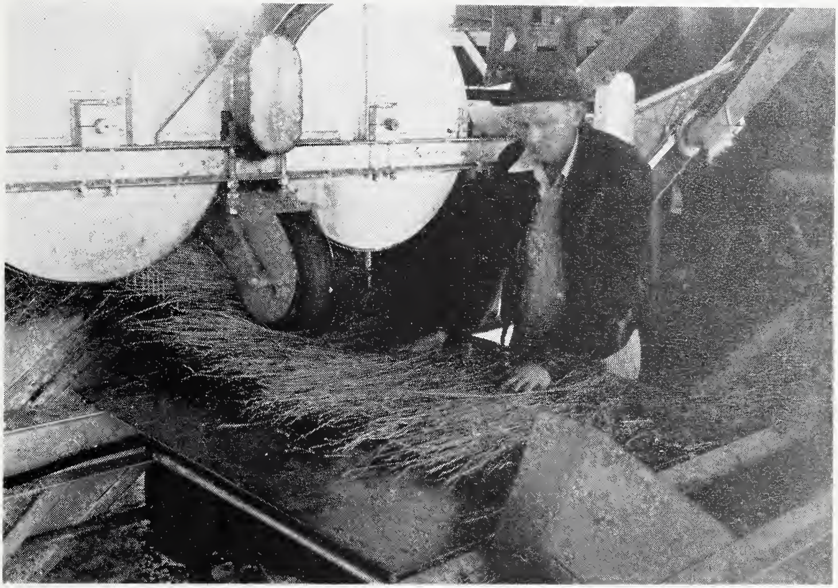

Figure 4.—Flax deseeding with a double-drum revolving-comb deseeder.

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[1] Widger, M. C. deseeding and cleaning machine. (U. S. Patent No. 2,313,791). U. S. Patent Office, Off. Gaz. 548: 458, illus. 1943.

Hurst, W. M. fiber-flax machinery and processing operations in oregon. U. S. Dept. Agr. Cir. 667, 27 pp., illus. 1943.

processed on a single-drum machine. The addition of the second set of combs, however, was found virtually to double the construction cost of the deseeder, which in the opinion of the processing-plant managers offset the advantage of the double-drum deseeder. This resulted in the adoption of the single-drum machine.

Through research this machine and auxiliary equipment has been improved so that fiber flax can be efficiently deseëded at a rate of more than 3 tons of pulled flax per hour. The latest machine consists of three combs equally spaced on a 44-inch-diameter circle in a 48-inch drum. The drum consists of three plates with one end of the comb shaft forming a crank and connecting to bearings mounted on a third drum plate. All three of the comb-assembly plates revolve at identical speeds. The third disk rotates the combs so that they are held in a vertical position throughout the 360° arc. A three-blade rubber-tipped wiper that revolves at a synchronous speed is located so that the combs are wiped clean once during each cycle (fig. 5).

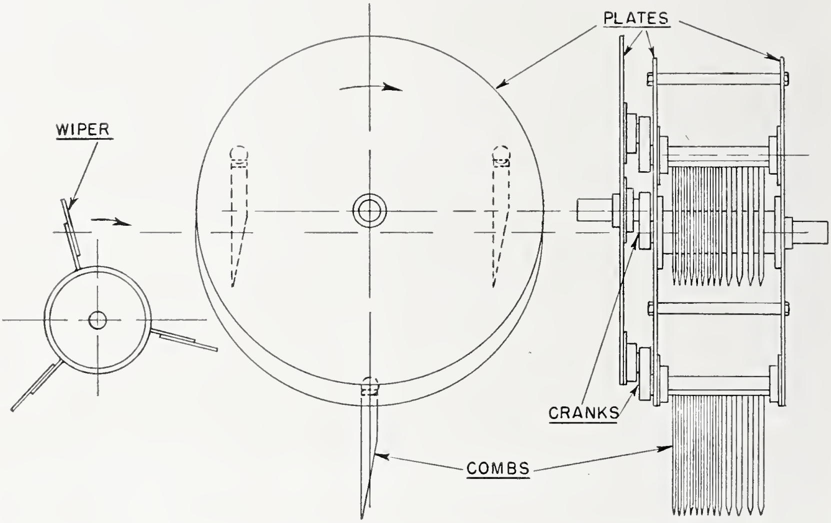

FIGURE 5.—Diagram of revolving-comb deseeder.

It is necessary for the root ends of the straw to be even to prevent excessive loss of seed and straw in this and other subsequent processing operations. With earlier models, this straw preparation and feeding was done by hand. In this new machine the butting operation is done mechanically by the addition of a butting and take-off table inclined at a 60° angle (fig. 6). The table has two parallel conveying belts that carry the bundles to the gripping device. The straw is mechanically butted as it is conveyed into the machine. The hold-back fingers at the entrance of the deseeder spread the bundle to approximately half its original thickness. The spreader is essentially a throat formed by adjustable metal fingers that regulate the thickness of the straw layers.

The combs are so constructed that the flax straw is combed once by coarse teeth to straighten the crossed straws and twice by fine teeth to strip the seed pods. The straw passes from the deseeder over the butting and conveying take-off table into the double-needle binder. An attachment at the entrance of the double-needle binder automatically stops the flow of straw momentarily, allowing the binder to tie two strings around each bundle.

A crew of five men is required to operate the deseeding unit. One unloads the seeded bundles from the wagon, a second man cuts the bundle bands, a third places the bundles on the butting and take-off table, a fourth places the deseeded bundles of straw on a second wagon, and a fifth operates the seed thresher.

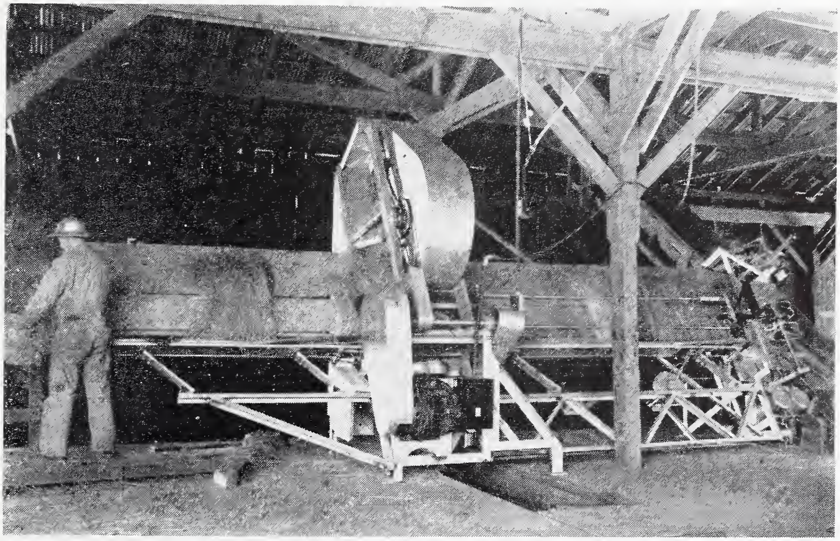

FIGURE 6.—Revolving-comb deseeder that evens straw, feeds and conveys flax to deseeder, and then binds straw by automatically retying it into bundles of uniform size with two strings.

CONCLUSIONS

The revolving-comb deseeder and its auxiliary equipment will process more than 3 tons of pulled flax per hour. The experimental unit has satisfactorily deseeded more than 1,000 tons of straw in a commercial processing plant. The straw deseeded with this machine was free of seed and the bundles were well butted, neat, and of uniform size. The capacity of the machine has been limited thus far by the physical ability of the crew to handle the flax and not by the deseeder itself.

Approximately 1.8 man-hours are required to deseed a ton of straw with this machine as compared with 20 man-hours with the ripple deseeder, 10 with the whipper deseeder, and 7 with the imported rake-type comb deseeder.

The value of this machine is far greater than the cost of the labor saved, in that it reduces the waste in the subsequent operations and results in a more uniform fiber that is better suited to the spinner's needs.

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